AEDC-TSR-78-P48

November 9, 1978

MODEL DIFFUSER INVESTIGATION FOR PROPULSION WIND TUNNEL 16T

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Period Covered: April 21 - September 5, 1978

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Prepared for: AEDC/DOTR
Arnold Air Force Station, TN 37389

ARNOLD ENGINEERING DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
ARNOLD AIR FORCE STATION, TENNESSEE

REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: AEDC-TSR-78-P48	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): MODEL DIFFUSER INVESTIGATION FOR PROPULSION WIND TUNNEL 16T	5. TYPE OF REPORT & PERIOD COVERED: Final Report - April 21-Sept. 5, 1978
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): L. J. David and M. G. Hale, ARO, Inc., a Sverdrup Corporation Company	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Arnold Engineering Development Center/DOTR, Air Force Systems Command, Arnold Air Force Station, Tennessee 37389	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: Program Element 65807F
11. CONTROLLING OFFICE NAME AND ADDRESS: Arnold Engineering Development Center/OIS, Air Force Systems Command, Arnold Air Force Station, Tennessee 37389	12. REPORT DATE: October 1978
	13. NUMBER OF PAGES: 32
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Aerodynamic testing
Transonic diffusers

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A 1/16-scale model of the diffuser of the Propulsion Wind Tunnel (16T) was installed and tested in the Aerodynamic Wind Tunnel (1T). Objectives of the test were to evaluate the effectiveness of a number of geometric modifications of the diffuser to improve diffuser performance. Thirteen configurations involving combinations of six geometric modifications were evaluated in the tunnel Mach number range from 0.60 to 1.50.

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NOMENCLATURE

M_∞	Free-stream Mach number
P_t	Total pressure, psfa
RTDM	Model diffuser pressure recovery
T_t	Total temperature, °F
TPR	Tunnel pressure ratio

1.0 INTRODUCTION

The work reported herein was conducted by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC) under Program Element 65807F. The project monitor was Capt. S. R. Lamkin. The test was conducted by ARO, Inc., AEDC Division (a Sverdrup Corporation Company), operating contractor for the AEDC, AFSC, Arnold Air Force Station, Tennessee, under ARO Project Number P41A-02. The test was conducted from April 21 through May 11, 1978 and from August 11 through September 5, 1978, in the Aerodynamic Wind Tunnel (1T) of the Propulsion Wind Tunnel Facility (PWT).

The purpose of the test was to evaluate the potential of diffuser modifications to improve the performance and decrease the energy consumption of Tunnel 16T. Data were obtained at tunnel free-stream Mach numbers from 0.6 to 1.5. Static and total pressures were measured in the test section and the model diffuser for each geometric modification.

The final data from this test have been retained at AEDC for analysis. Requests for these data should be addressed to the Director of Test Engineering (AEDC/DOTR), Arnold Air Force Station, Tennessee 37389.

2.0 APPARATUS

2.1 TEST FACILITY

The Aerodynamic Wind Tunnel (1T) is a continuous flow wind tunnel capable of being operated at Mach numbers from 0.20 to 1.50 at a stilling chamber pressure of approximately 2850 psfa and a stagnation temperature which varies from approximately 80 to 120°F above ambient air temperature. The test section is 12-in. square in cross section and 37.50-in. long. Figure 1a shows the Tunnel 1T test section configuration. Additional information about the tunnel, its capabilities, and operating characteristics is given in Ref. 1.

2.2 TEST INSTALLATION

2.2.1 Test Section

The test section of Tunnel 1T was altered to simulate the aerodynamic test section of Tunnel 16T; however, standard 1T porous wall liners were utilized. Figure 1b shows the installation of the test section components in Tunnel 1T. The test section top and bottom walls included a one-sixteenth scale model of the Tunnel 16T aerodynamic test section bulge region. Testing was conducted with both porous and solid sidewalls in the bulge region. A centerline static pipe was also installed on a one-sixteenth scale model of the Tunnel 16T sting support system. For a portion of the test, a blunt leading edge was installed on the sting support strut as shown in Fig. 2.

2.2.2 Model Diffuser

The diffuser installed in Tunnel 1T was a 1/16-scale model of the diffuser of Tunnel 16T. Figure 3 shows the installation of the model diffuser in 1T. The model diffuser consisted of four major components: the rectangular section, the transition section, the conical section, and the scavenging scoop. Other important elements which simulated the Tunnel 16T diffuser include the scoop tips, the reentry air flaps, the turnout strut, and a simulated compressor protection screen. The dimensions and configurations of the three diffuser sections were scaled from the drawings of the full-scale diffuser, but some differences in scaling the scavenging scoop were necessary. In Tunnel 16T, the downstream end of the scavenging scoop flairs into a horizontal airfoil shaped turnout strut which functions as the downstream support for the scoop and as a conduit for removal of the scavenged flow from the tunnel and the entry of makeup air. Fabrication costs for scaling that portion of the scoop and the turnout strut would have been excessive. Therefore, the model scoop was designed as a combined support strut and equivalent body of revolution giving the same annular geometric flow area as exists in Tunnel 16T to the trailing edge of the turnout strut.

2.2.3 Scoop Tips

For aerodynamic testing in Tunnel 16T, the upstream end of the scavenging scoop is closed with a conical tip as indicated by Fig. 3. One modification of the model diffuser involved replacement of the conical tip with a secant ogive tip on the assumption that the streamlined contour of the latter would reduce pressure losses through the diffuser. Dimensions and contours of the two scaled tips are shown in Fig. 4.

2.2.4 Splitter

For supersonic test section Mach numbers, the flow is assumed to be bifurcated by the model support strut at the entrance to the diffuser. On the assumption that an interaction between shock systems behind the strut might be responsible for excessive pressure loss, a solid surface (splitter) was installed in the rectangular section of the diffuser as illustrated by Fig. 5. The splitter extended from the inlet of the rectangular section to a point downstream of the tip of the scavenging scoop.

2.2.5 Corner Fillers

Separation of flow in the corners of the rectangular section is a possible loss mechanism. Two corner filler configurations were tested. The solid corner filler, Fig. 6a, had solid surfaces exposed to the airflow. The baffle corner filler design had a baffled surface as shown in Fig. 6b. The baffles were intended to energize the boundary layer in the corners to minimize the possible effects of flow separation.

2.2.6 Screens

The initial 1T model diffuser configuration did not include a simulated compressor protection screen. Although not intended as a geometric modification for improving diffuser performance, a screen was installed to simulate the compressor protective screen in Tunnel 16T during the latter part of the first entry. The axial location of the simulated screen in the conical section of the model diffuser is shown by Fig. 7a. The screen was made in two sections. An upstream view showing one-half of the screen in place during installation is shown in Fig. 7b. The initial screen installation, Screen No. 1, included two layers of 2.25 mesh, 0.072-inch wire on the upstream face of a sheet metal framework. Since larger than planned pressure losses resulted using Screen No. 1, a second screen, Screen No. 2, was designed and installed during the second test entry. Screen No. 2 utilized only one layer of 2.25 mesh, 0.072-inch wire.

2.2.7 Partial Scavenging Scoop

The scavenging scoop was separated at Sta. 93.56 and the upstream portion of the scoop was removed and replaced with an ogive-shaped closure shown in Fig. 8. Thus, the scavenging scoop was removed from the diffuser in the high Mach number region of the diffuser flow (upstream).

2.3 TEST INSTRUMENTATION

The performance of the model diffuser and the effect of geometric modifications were evaluated from static and total pressure measurements. The pressure measurements included 66 wall static pressures on the diffuser shell and 35 static pressures on the surface of the scavenging scoop. These pressures were positioned as listed in Table 1. As shown in Figs. 9 and 10, 32 total pressures (four rakes) at the diffuser inlet (Sta. 37.5) and 97 total pressures (eight rakes and one centerline tap) at the diffuser exit (Sta. 163.83) were measured during parts of the testing.

A 1-in.-diam static pressure pipe was used to obtain centerline static pressure distributions. The pipe was attached to the sting support system and extended into the stilling chamber to eliminate pipe nose disturbances. A total of 28 pipe orifices were utilized to measure the pressure distribution along the test section centerline. As shown in Table 1, the centerline pressure distributions were obtained from Stations 0 to 27.

The static and total pressures were measured by transducers installed in Scanivalves®. The plenum chamber pressure was measured by a self-balancing precision manometer. The tunnel stilling chamber pressure was measured by a 15-psi differential transducer utilizing a vacuum reference. The tunnel plenum and reentry airflows were calculated from pressures measured across square-edged orifices. The orifice upstream and differential pressures were measured by 5-psi differential transducers.

An attempt was made to measure the net force acting on the model diffuser as a means of evaluating the performance of the diffuser. The model diffuser was mounted on flexures and load cells were used for force measurement. Inconsistent tares were encountered, and force measurements were discontinued at an early stage in the test program.

3.0 TEST DESCRIPTION

3.1 TEST PROCEDURE

Steady-state data were taken at each Mach number tested. The tunnel pressure ratio was varied at each Mach number to the lowest possible ratio which maintained constant test section Mach number. The reentry airflow was matched to the suction flow through the test section walls to simulate Tunnel 16T operational techniques. The opening set for the reentry air flaps was optimized by setting the minimum opening which did not choke the reentry airflow. Early in the second entry, flap position setting of 75% of full open was found to be adequate for all flow settings and was used thereafter. Normal tunnel operating procedures were used except that a Mach number 1.10 nozzle was normally set for runs at Mach 1.10. A test summary by part number is presented in Table 2.

3.2 DATA REDUCTION

The standard Tunnel 1T data acquisition and data reduction equations, together with online and offline project peculiar data reduction equations were used to reduce the data to engineering units. Standard tunnel parameters, model pressures, and diffuser performance indices such as tunnel pressure ratio, flow rates, inlet and exit Mach numbers, pressure loss coefficients, and pressure recovery, were computed, tabulated, and stored on magnetic tape. Selected pressure data were displayed on a CRT in the control room.

Mach number and total pressure were computed at the various stations in the model diffuser on the basis of continuity, the measured static pressures, and the assumption of one-dimensional flow. The mass flow rate, total temperature, and geometric flow area were known at each station, and in conjunction with the measured static pressure were used in the continuity relationship to obtain the one-dimensional Mach number. That value for Mach number, the measured static pressure, and the isentropic relationship were used to obtain the one-dimensional station total pressure.

3.3 MEASUREMENT UNCERTAINTY

The estimated uncertainty (a combination of systematic and random error) in Mach number and other wind tunnel parameters were estimated from repeat calibrations of the instrumentation against secondary standards whose precisions are traceable to the National Bureau of Standards calibration equipment. The instrument uncertainties were combined using the method described in Ref. 2 to estimate the uncertainties of the tunnel standard and test parameters shown below and in Fig. 11.

Parameter	ΔM_∞	P_t	T_t	TPR	RTDM
Uncertainties	±0.005	±3.1 psf	±4.1°F	±1.6%	±0.0036 psf

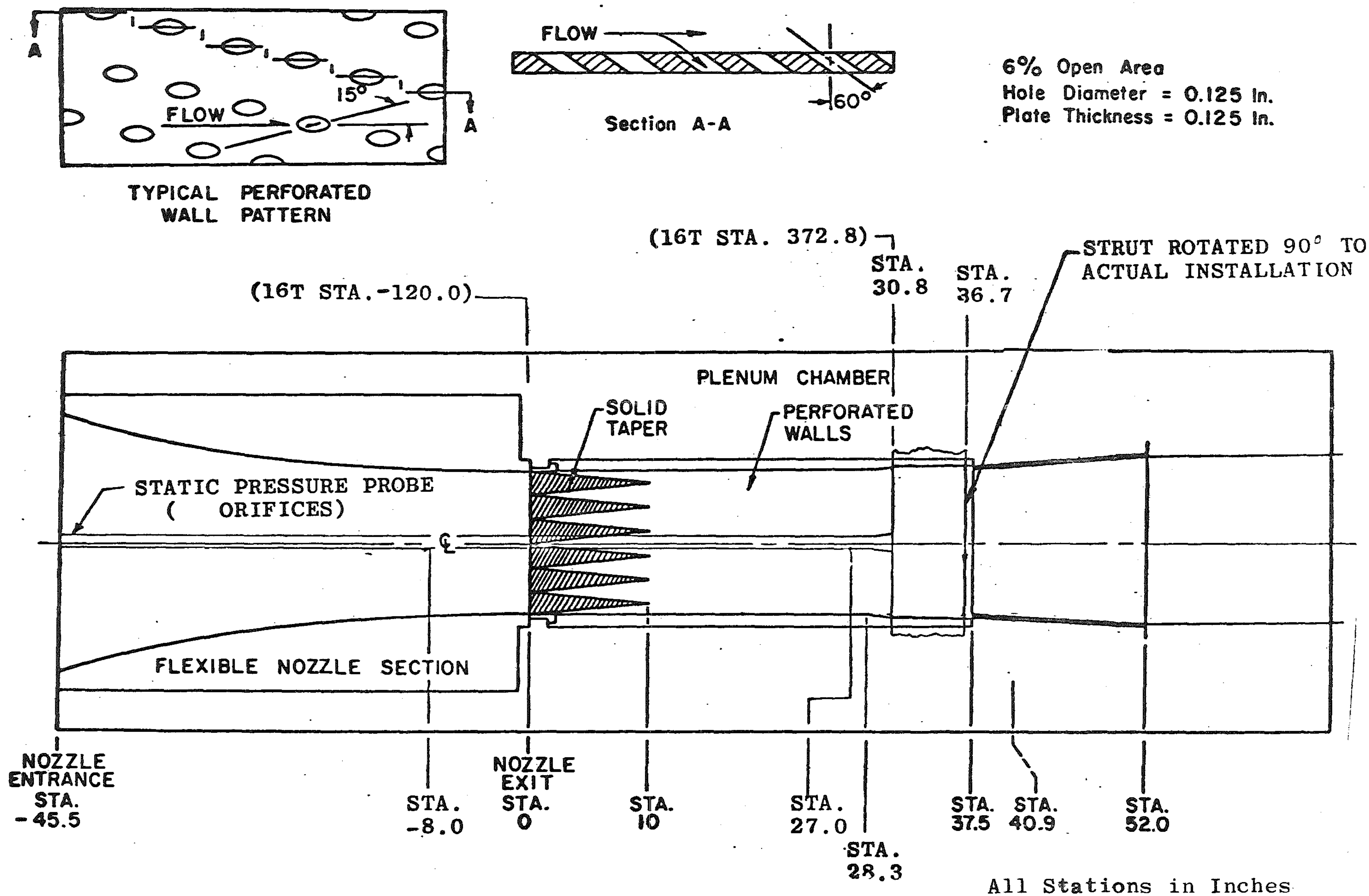
4.0 DATA PACKAGE PRESENTATION

A sample of the tabulated summary data is shown in Table 3. The nomenclature for the summary data is presented in Table 4. The data have been retained at AEDC for analysis.

REFERENCES

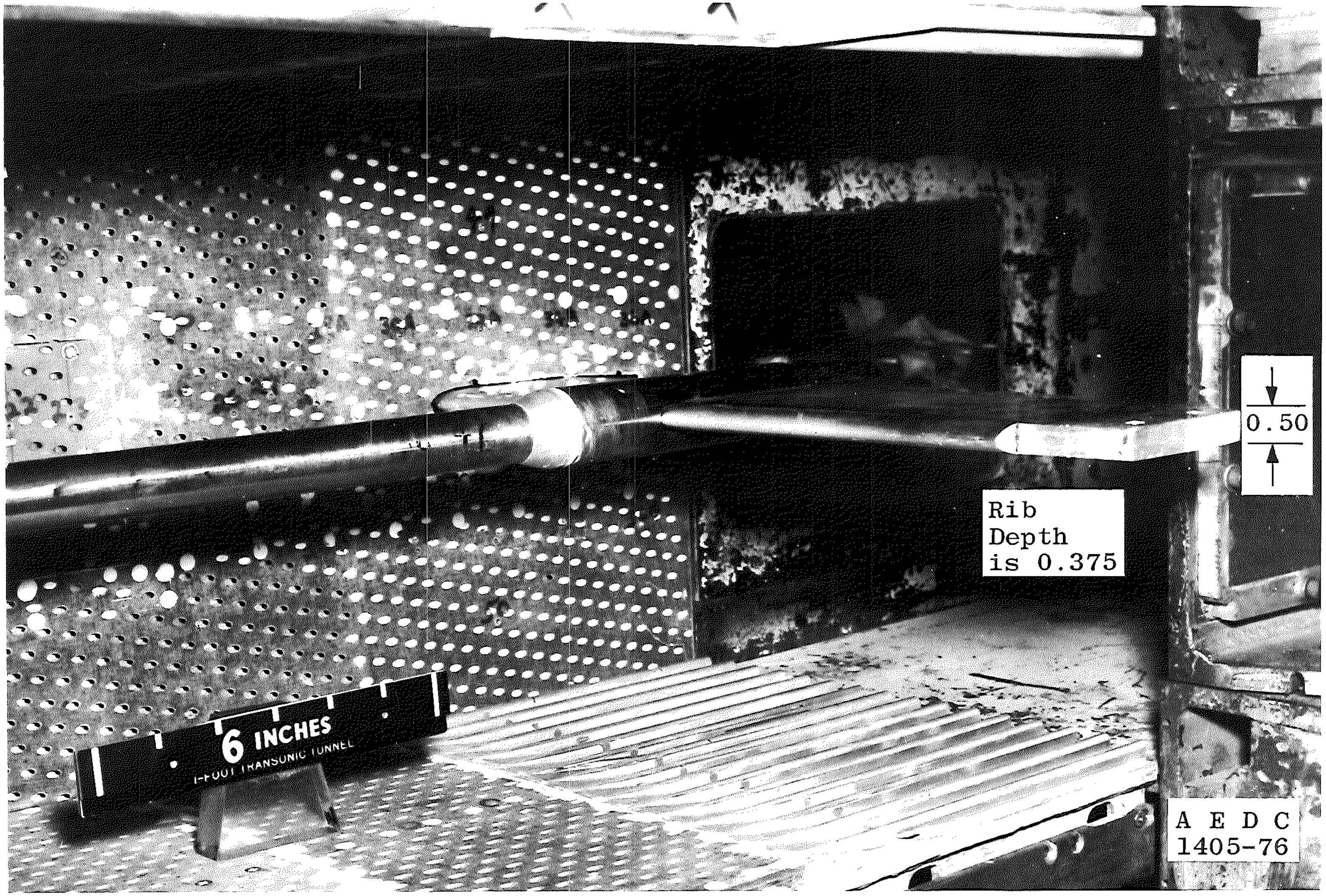
1. Test Facilities Handbook (Tenth Edition). "Propulsion Wind Tunnel Facility, Vol. 4." Arnold Engineering Development Center, May 1974.

2. Abernethy, Thompson, et al. "Handbook - Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5, February 1973.



a. Test Section Dimensions

Figure 1. Tunnel 1T Test Section Installation



b. Tunnel 16T Aerodynamic Test Section Simulation

Figure 1. Concluded

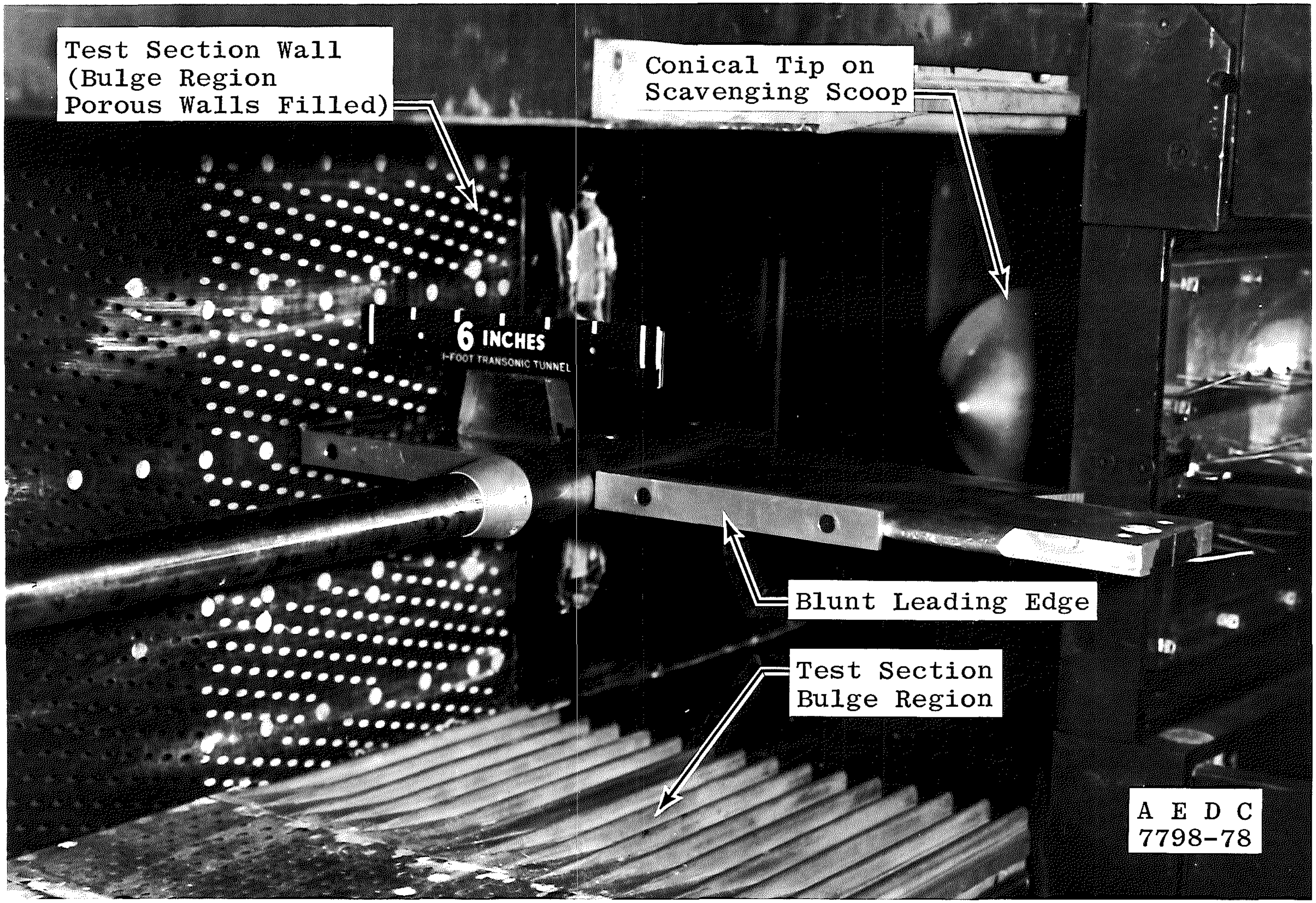


Figure 2. Blunt Strut Leading Edge

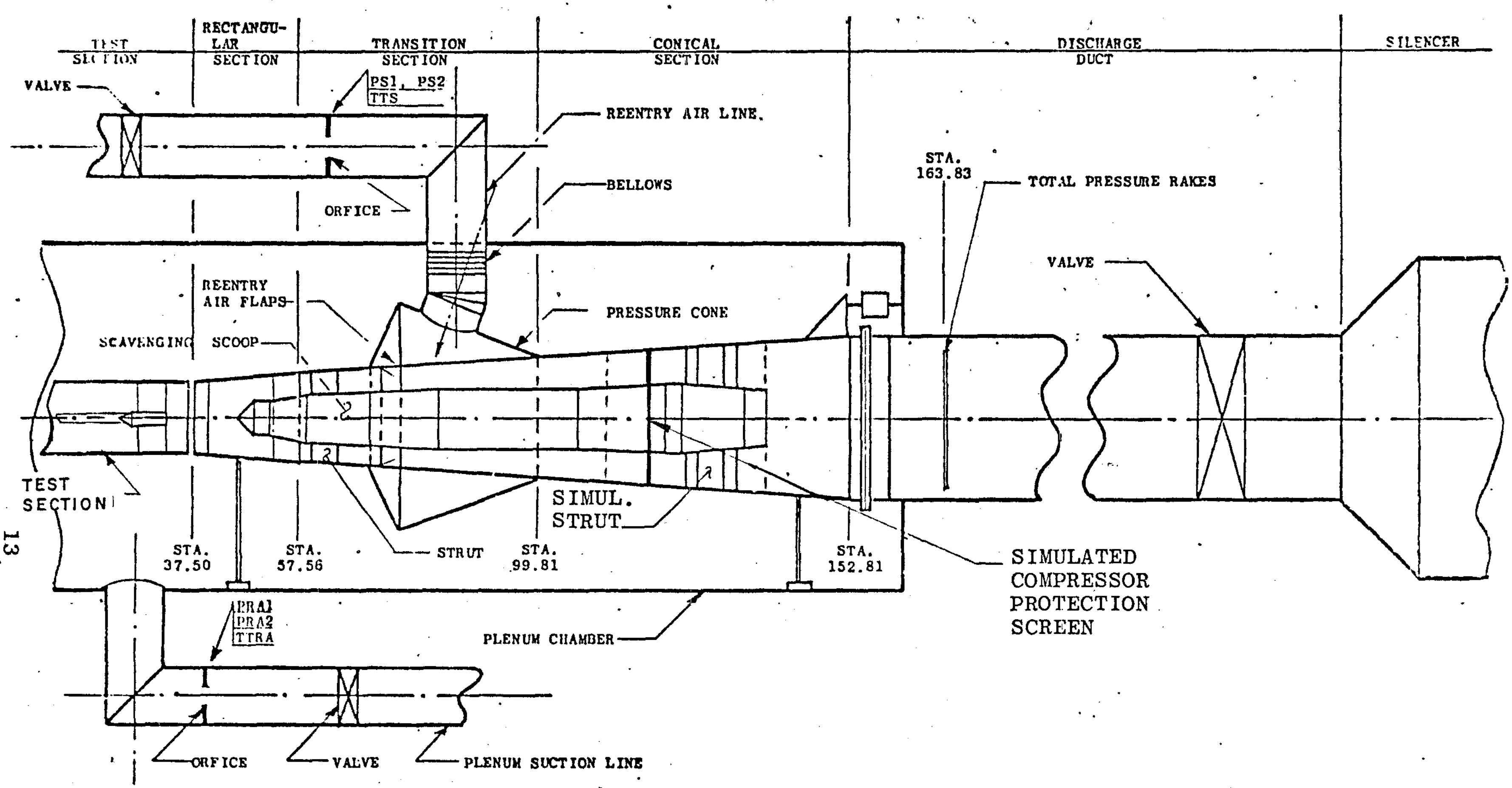
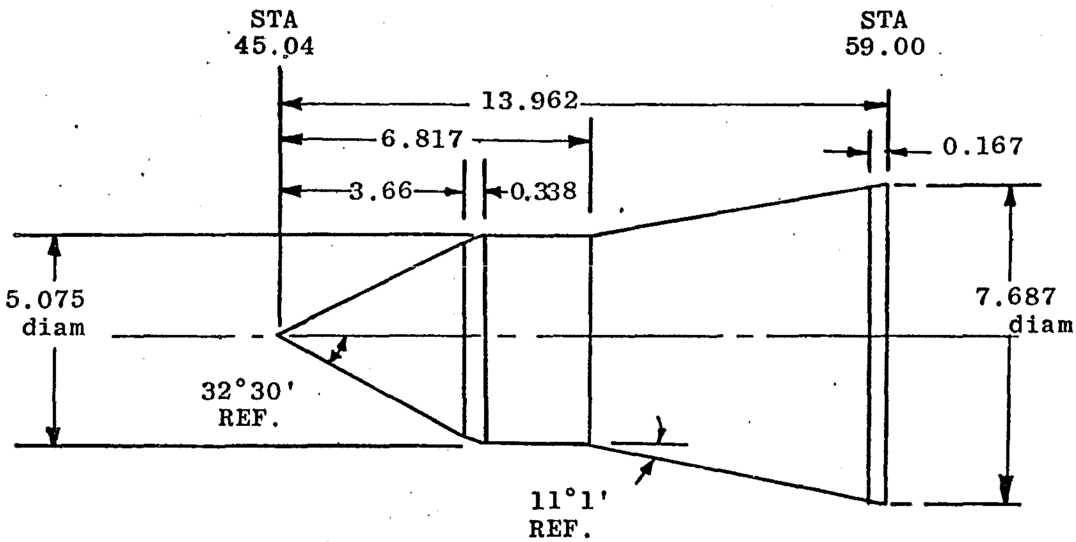
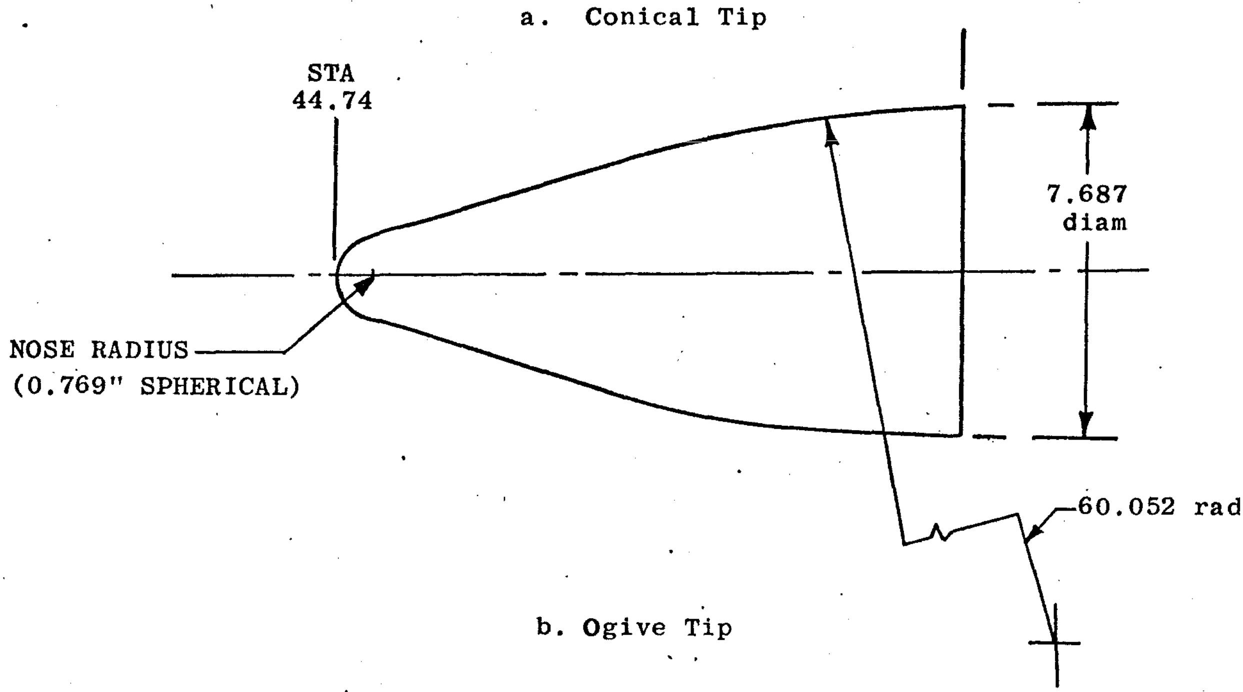


Figure 3. Tunnel 16T Model Diffuser in Tunnel 1T



a. Conical Tip



b. Ogive Tip

Figure 4. Scavenging Scoop Tips

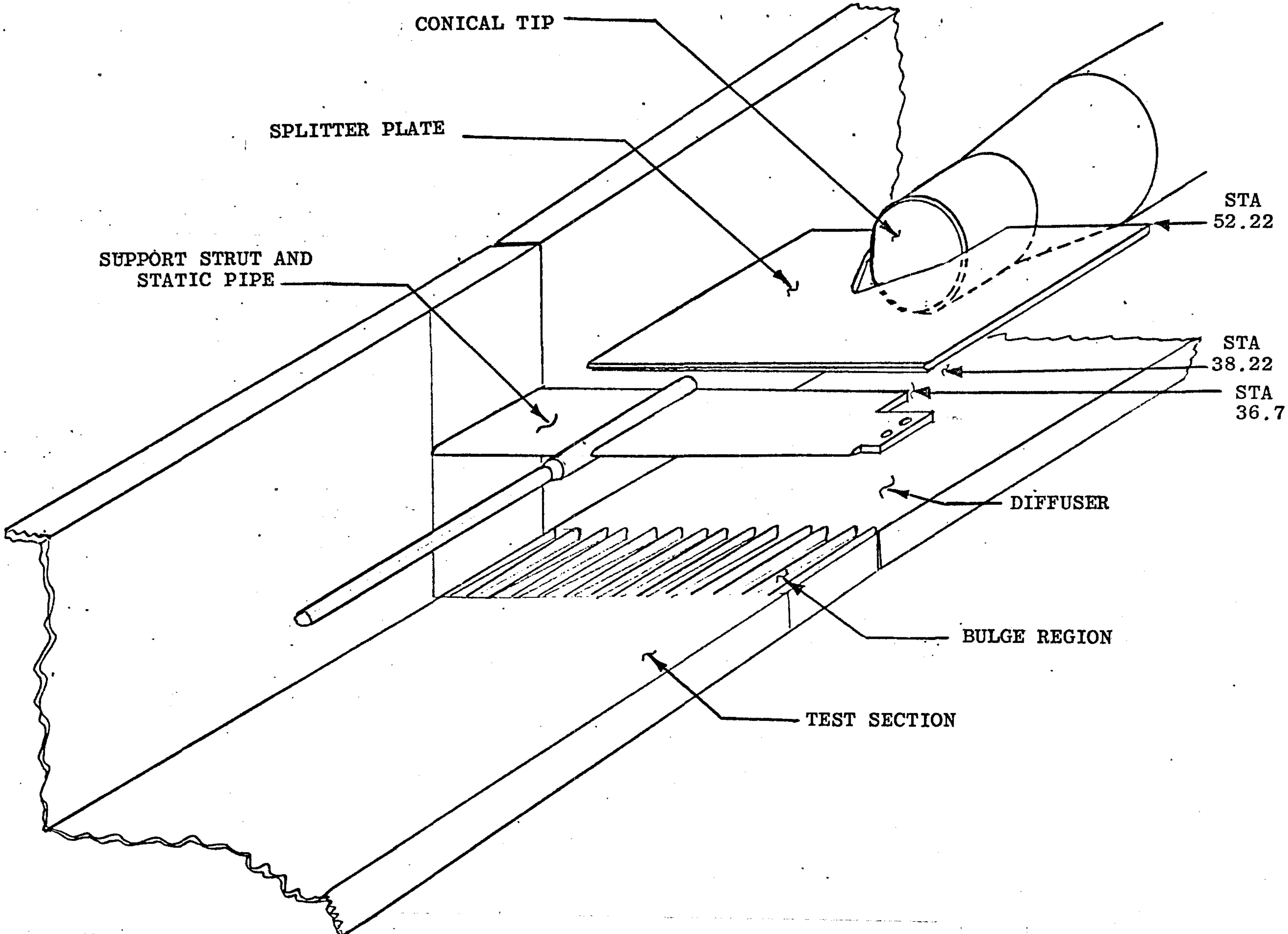
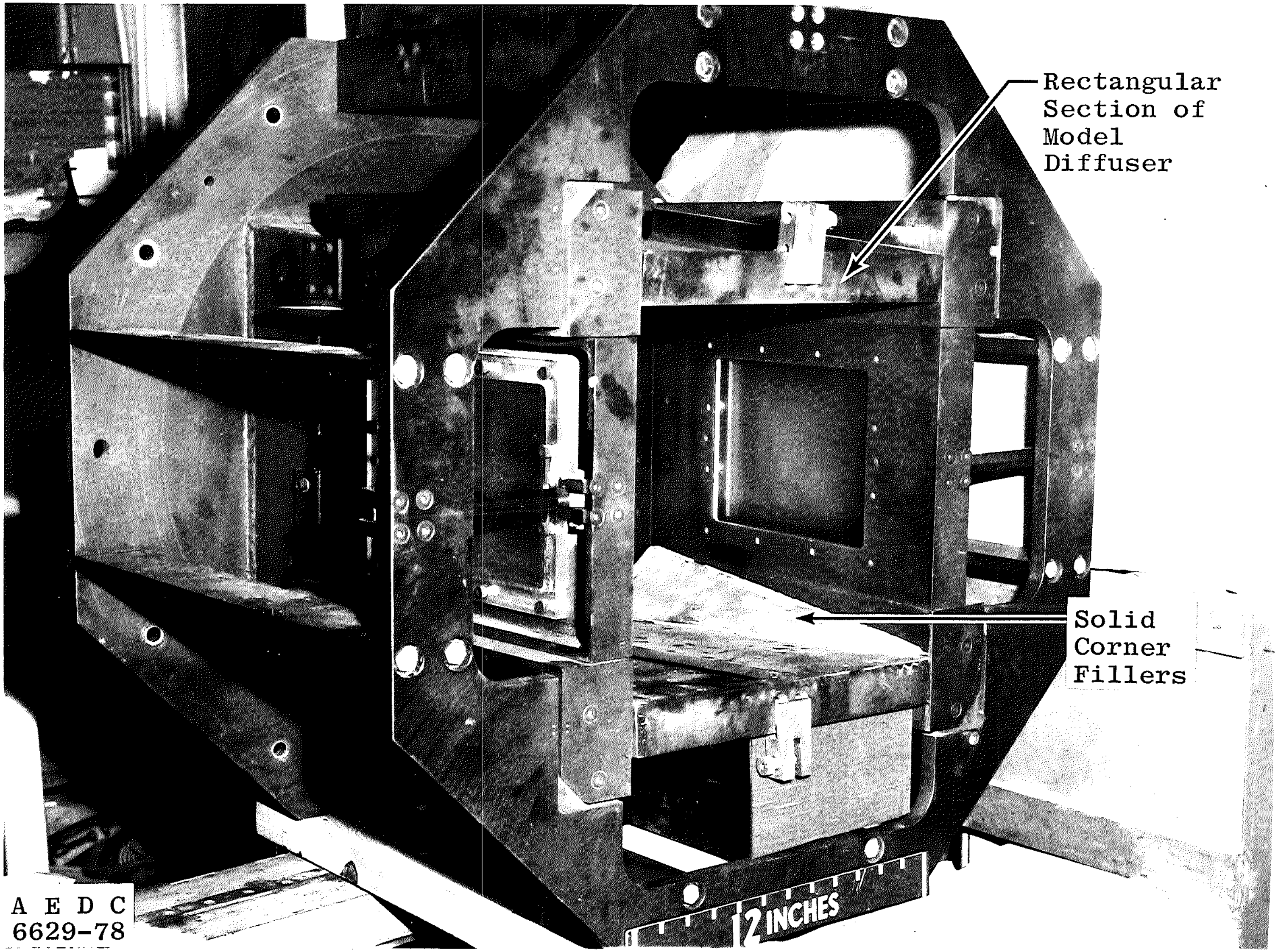
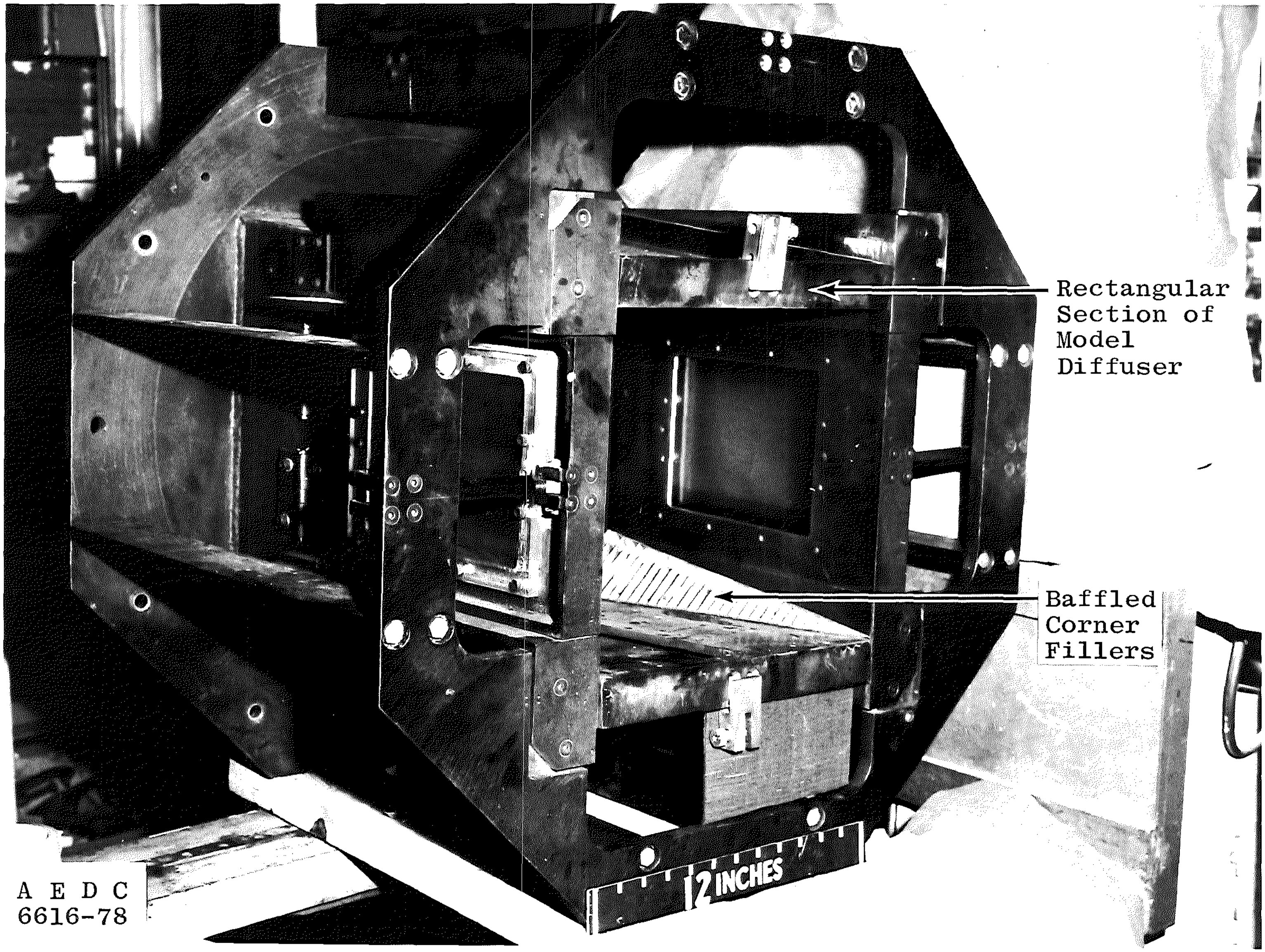


Figure 5. Splitter Plate Installation



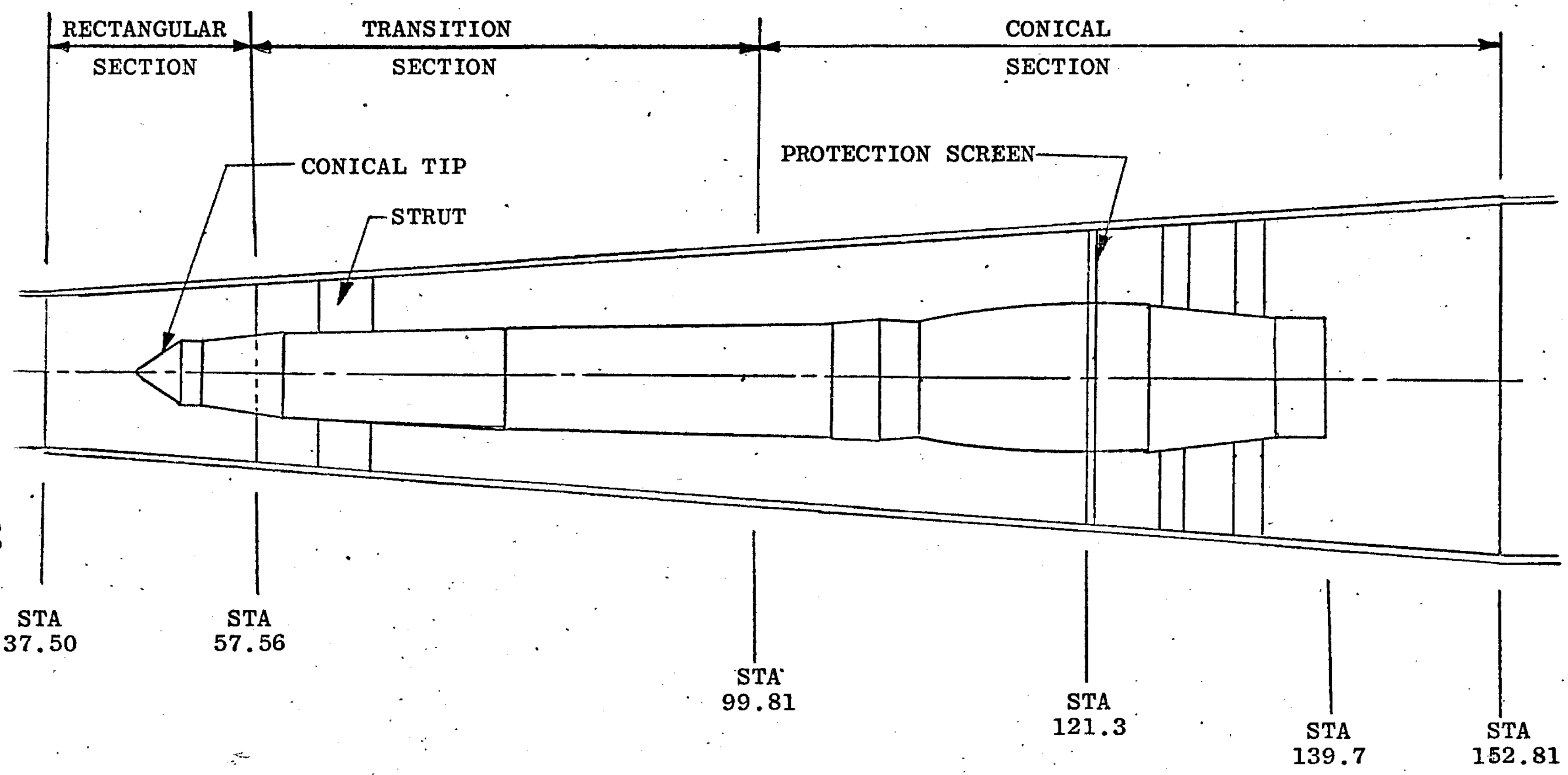
a. Solid Corner Fillers

Figure 6. Corner Filler Installation

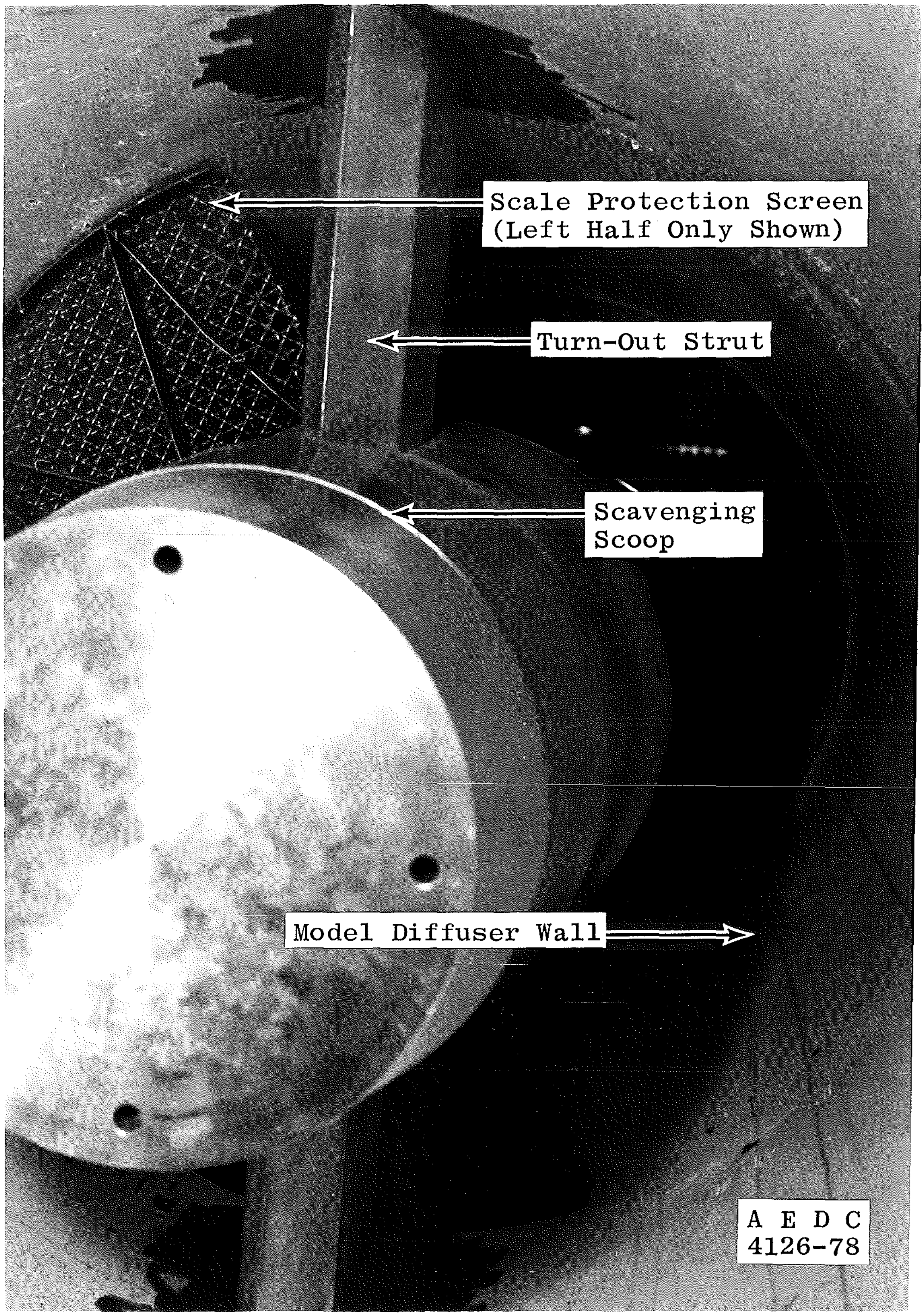


b. Baffled Corner Filler

Figure 6. Concluded



a. Location
Figure 7. Simulated Compressor Protection Screen



b. Installation

Figure 7. Concluded

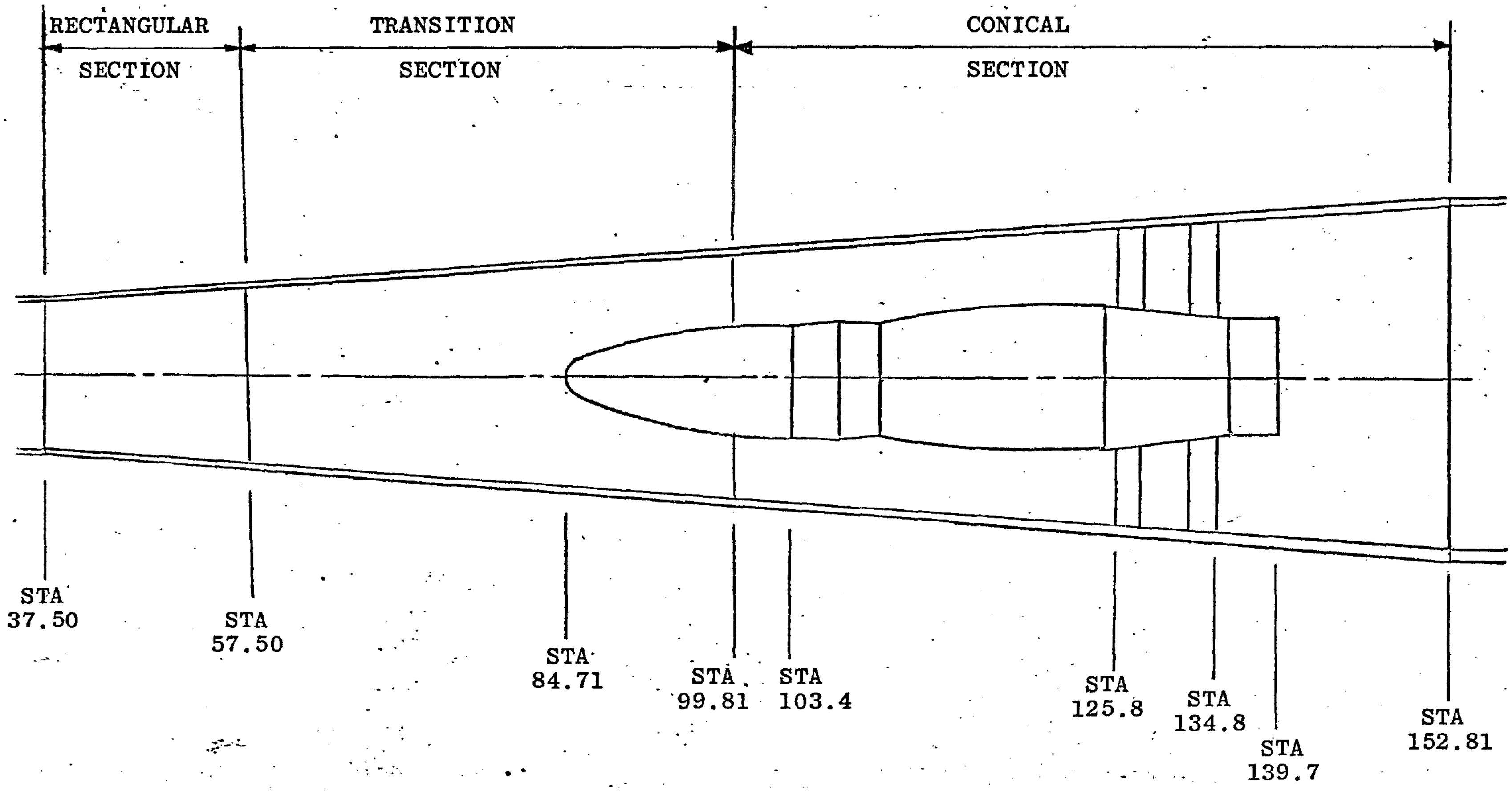
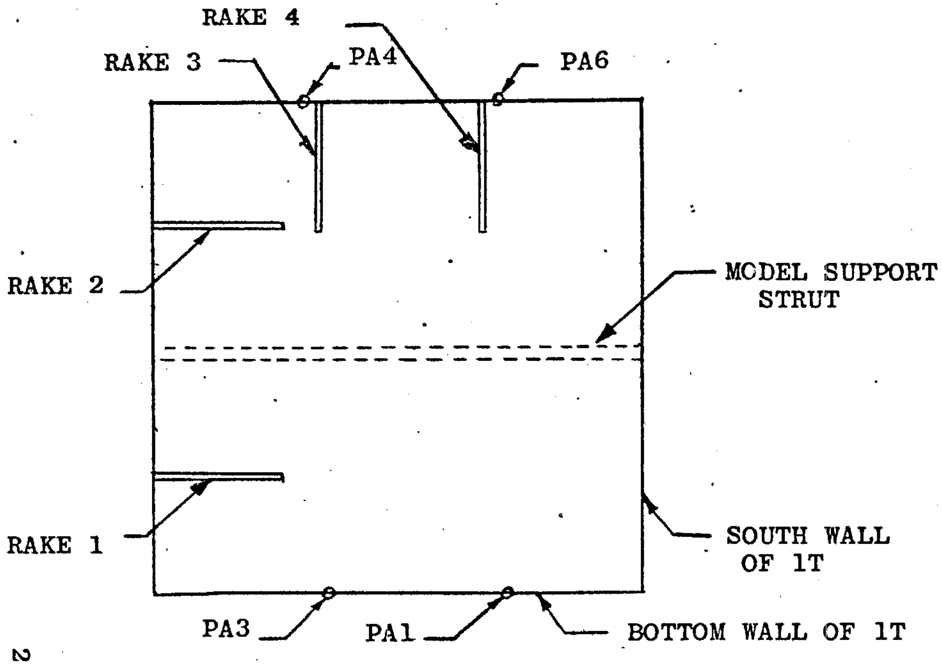


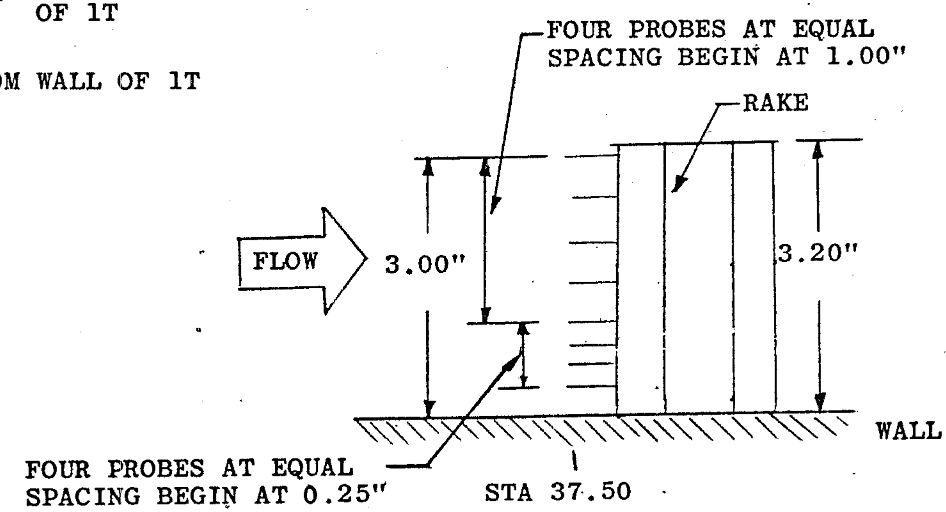
Figure 8. Partial Seavenging Scoop



VIEW LOOKING DOWNSTREAM

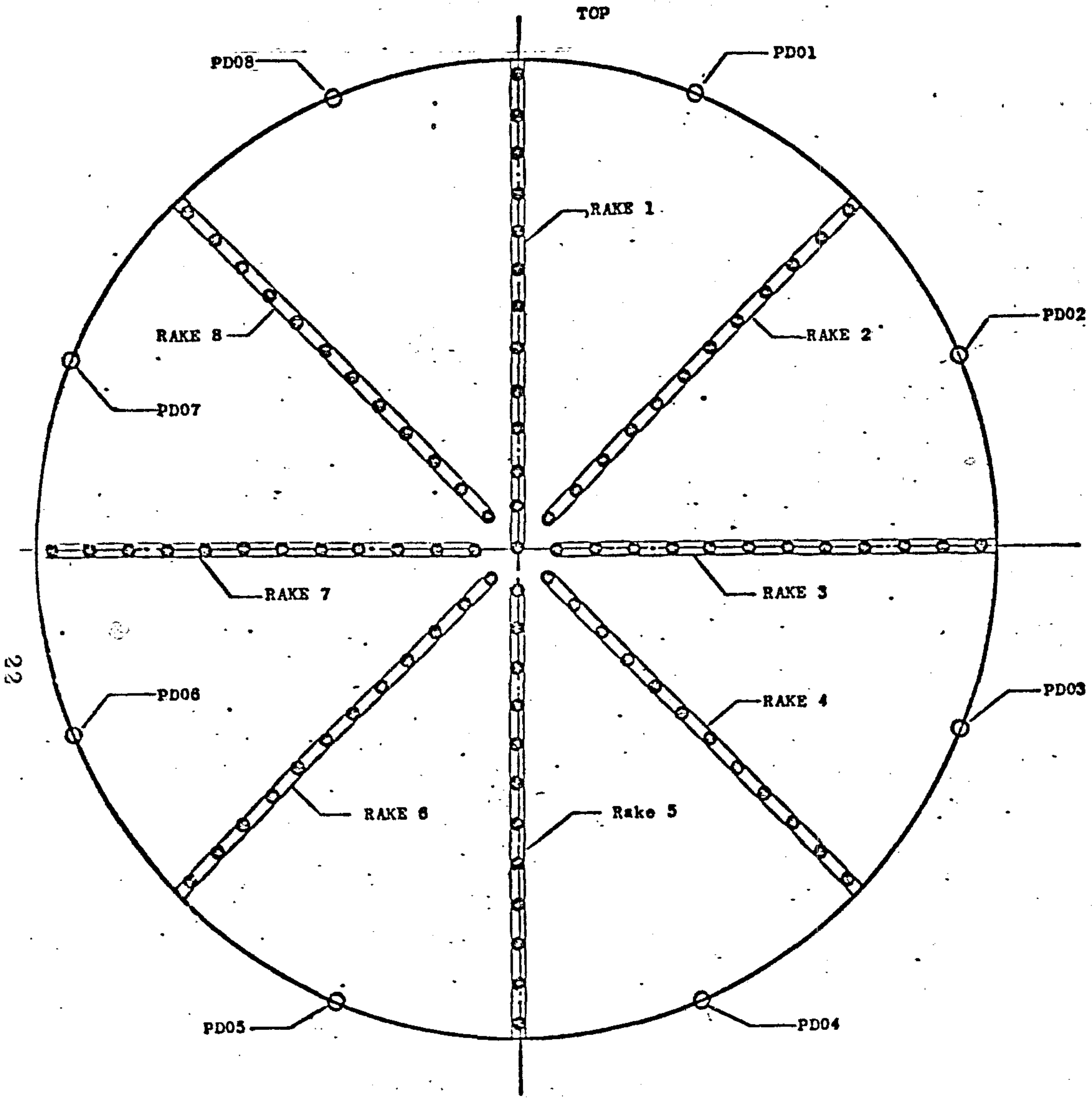
TOTAL PRESSURE PROBES ARE DESIGNATED SEQUENTIALLY FROM INNER TO OUTER POSITIONS AS FOLLOWS:

RAKE NO.	TOTAL PRESSUR PROBE
1	PP1 to PP8
2	PP9 to PP16
3	PP17 to PP24
4	PP25 to PP28, P18, 20, 22



TYPICAL RAKE PROFILE

Figure 9. Upstream Total Pressure Rakes



RAKES ARE DESIGNATED SEQUENTIALLY CLOCKWISE IN DOWNSTREAM VIEW AS INDICATED.

TOTAL PRESSURE PROBES ARE DESIGNATED SEQUENTIALLY FROM OUTER TO INNER RADIAL POSITIONS AS FOLLOWS -

RAKE NO.	TOTAL PRESSURE PROBES
1	PTD101 to PTD113
2	PTD201 to PTD212
3	PTD301 to PTD312
4	PTD401 to PTD412
5	PTD501 to PTD512
6	PTD601 to PTD612
7	PTD701 to PTD712
8	PTD801 to PTD812

REF. PWT DWG. PA006163

Figure 10. Downstream Total Pressure Rakes

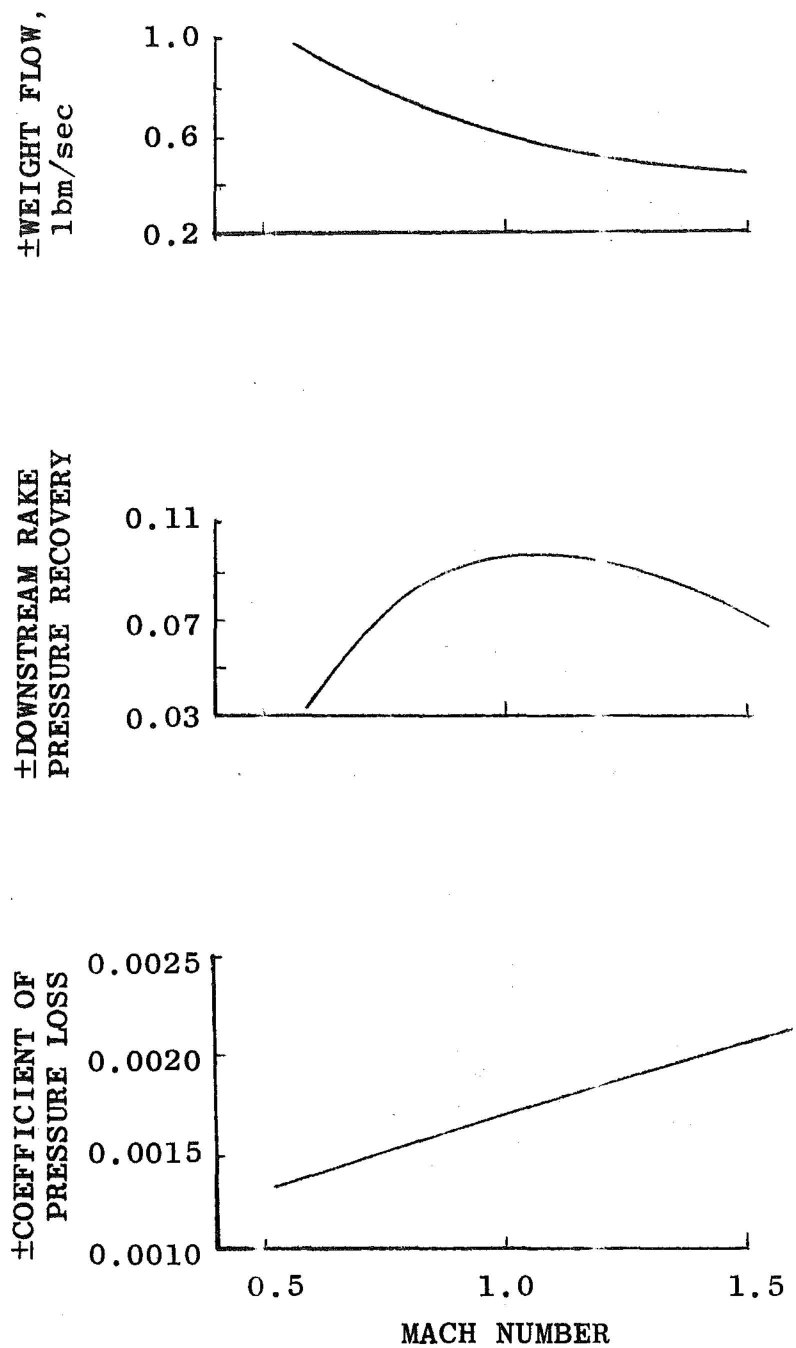


Figure 11. Estimated Uncertainties in Parameters

TABLE 1. STATIC ORIFICE LOCATIONS

Centerline Static Pipe		Diffuser Wall Rectangular		Diffuser Wall Transition		Diffuser Wall Conical		Scavenging Scoop		
								Station, in.		
Station, in.	Nomenclature	Station, in.	Nomenclature	Station, in.	Nomenclature	Station, in.	Nomenclature	Conical Tip	Ogive Tip	Nomenclature
0.0	PP 1					103.48	PC 1	45.04	44.74	PE 01
1.0	PP 2	38.25	PA 1	59.11	PB 1	106.21	PC 2	46.26	47.12	PE 02
2.0	PP 3	38.25	PA 2	62.03	PB 2	108.94	PC 3	47.48	49.50	PE 03
3.0	PP 4	38.25	PA 3	64.95	PB 3	110.67	PC 4	50.45	51.83	PE 04
4.0	PP 5	38.25	PA 4	67.88	PB 4	114.39	PC 5	54.24	54.26	PE 05
5.0	PP 6	38.25	PA 5	70.80	PB 5	117.12	PC 6	56.62	56.64	PE 06
6.0	PP 7	38.25	PA 6	73.53	PB 6	119.86	PC 7	59.00		PE 07
7.0	PP 8	39.25	PA 7	76.26	PB 7	122.58	PC 8	61.93		PE 08
8.0	PP 9	40.25	PA 8	78.98	PB 8	125.31	PC 9	64.89		PE 09
9.0	PP 10	41.25	PA 9	81.71	PB 9	128.04	PC 10	67.77		PE 10
10.0	PP 11	42.25	PA 10	84.44	PB 10	130.76	PC 11	70.79		PE 11
11.0	PP 12	43.25	PA 11	87.16	PB 11	133.49	PC 12	73.42		PE 12
12.0	PP 13	44.25	PA 12	89.89	PB 12	136.22	PC 13	76.15		PE 13
13.0	PP 14	45.25	PA 13	92.62	PB 13	138.95	PC 14	78.88		PE 14
14.0	PP 15	46.25	PA 14	95.34	PB 14	141.67	PC 15	81.60		PE 15
15.0	PP 16	47.25	PA 15	98.07	PB 15	144.40	PC 16	84.33		PE 16
16.0	PP 17	48.25	PA 16			147.13	PC 17	87.06		PE 17
17.0	PP 18	49.25	PA 17			149.85	PC 18	89.79		PE 18
18.0	PP 19	50.25	PA 18					92.51		PE 19
19.0	PP 20	51.25	PA 19					98.03		PE 20
20.0	PP 21	52.25	PA 20			163.83	PD 1	100.75		PE 21
21.0	PP 22	53.25	PA 21			163.83	PD 2	103.43		PE 22
22.0	PP 23	54.25	PA 22			163.83	PD 3	106.21		PE 23
23.0	PP 24	55.25	PA 23			163.83	PD 4	108.93		PE 24
24.0	PP 25	56.25	PA 24			163.83	PD 5	111.66		PE 25
25.0	PP 26	57.25	PA 25			163.83	PD 6	114.39		PE 26
26.0	PP 27					163.83	PD 7	117.11		PE 27
27.0	PP 28					163.83	PD 8	119.84		PE 28
								122.57		PE 29
								125.30		PE 30
								128.02		PE 31
								130.75		PE 32
								133.48		PE 33
								136.20		PE 34
								138.93		PE 35

TABLE 2. TEST SUMMARY

Part Range	M_∞ Range	Test Section: Open Walls	Test Section: Solid Walls	Test Section: Blunt L.E.	Model Diffuser: Cone Tip	Model Diffuser: Ogive Tip	Model Diffuser: Splitter	Model Diffuser: Solid Corners	Model Diffuser: Baffle Corners	Model Diffuser: Screen 1	Model Diffuser: Screen 2	Configuration No.: Test Section	Configuration No.: Model Diffuser
22- 33	0.6-1.5	√			√							1.001	2.001
36- 48	0.8-1.5	√			√		√					1.001	2.007
51- 66	0.8-1.5	√				√	√					1.001	2.008
69- 76	0.8-1.5	√				√						1.001	2.002
79- 87	0.6-1.4	√				√		√		√		1.001	3.201
90- 97	0.6-1.4	√				√	√	√		√		1.001	3.202
100-112	0.6-1.4	√				√	√			√		1.001	3.008
200-215	0.6-1.4	√			√						√	1.001	4.001
216-224	0.6-1.4	√			√			√			√	1.001	4.205
225-236	0.6-1.5		√		√				√		√	1.002	4.207
237-246	0.6-1.5		√		√						√	1.002	4.001
247-258	0.6-1.5		√		√			√			√	1.002	4.205
259-264	0.6-1.5		√		√		√				√	1.002	4.007
265-274	0.6-1.5		√			√					√	1.002	4.002
275-283	0.6-1.5		√			√	√				√	1.002	4.008
300-316	0.6-1.5		√		√							1.002	5.001
400-406	1.1-1.5		√	√	√							1.003	2.001
407-413	1.1-1.5		√		√							1.002	2.001
414-429	0.6-1.5		√		*							1.002	1.000
430-438	0.6-1.5	√			*							1.001	1.000

*Scoop and Screens Removed

√Indicates configuration components installed

TABLE 3
SAMPLE OF TABULATED DATA

TEST	PART	POINT	TEST-SECTION CONFIGURATION	DIFFUSER CONFIGURATION	DATE	HR	MN	SC
366	301	1	1.002	5.001	8/28/78	13	3	6

M	PT	P	Q	TT	T	RX10-6	WT	TPR	WA	WS/WT	PC
1.399	2866.0	901.6	1235.6	184.2	462.6	4.906	53.89	1.349	0.0	0.03	901.6

TEST-SECTION STATIC PIPE - PRESSURES

PP 1	PP 2	PP 3	PP 4	PP 5	PP 6	PP 7	PP 8	PP 9	PP10	PP11	PP12	PP13	PP14
1806.5	2319.1	2660.6	2653.3	2658.6	2669.0	2658.6	2685.3	1719.0	2180.7	2618.8	2724.6	2746.7	2722.8
PP15	PP16	PP17	PP18	PP19	PP20	PP21	PP22	PP23	PP24	PP25	PP26	PP27	PP28
2625.6	2654.3	1305.7	1556.5	2340.0	2530.7	2671.7	2714.7	2555.5	2676.7	1440.7	1922.1	2431.3	2583.7

DIFFUSER, RECTANGULAR SECTION - STATIC PRESSURES

PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	PA 7	PA 8	PA 9	PA10	PA11	PA12	PA13	PA14
857.7	0.0	858.5	909.4	0.0	888.8	1118.1	1224.6	1283.0	1322.8	1370.9	1425.2	1461.3	1508.1
PA15	PA16	PA17	PA18	PA19	PA20	PA21	PA22	PA23	PA24	PA25			
1467.5	2703.6	1404.1	2736.5	1393.0	2579.5	1481.5	2681.1	1578.9	1585.5	2069.3			

DIFFUSER, TRANSITION SECTION - STATIC PRESSURES

PB 1	PB 2	PB 3	PB 4	PB 5	PB 6	PB 7	PB 8	PB 9	PB10	PB11	PB12	PB13	PB14
0.0	1534.1	1638.8	1648.7	1847.1	1812.5	1791.4	1848.3	1829.1	1852.0	1834.1	1907.3	1928.3	1944.9
PB15													
0.0													

DIFFUSER, CONICAL SECTION - STATIC PRESSURES

PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC10	PC11	PC12	PC13	PC14
1961.4	1981.1	1986.8	1995.3	2005.1	2011.7	2023.3	0.0	901.6	0.0	0.0	2048.6	2049.4	2079.8
PC15	PC16	PC17	PC18										
2093.3	2098.2	2103.4	2116.3										

SCAVENGING SCOOP - STATIC PRESSURES

PE 1	PE 2	PE 3	PE 4	PE 5	PE 6	PE 7	PE 8	PE 9	PE10	PE11	PE12	PE13	PE14
1682.8	1852.7	1806.9	1173.6	1593.5	1556.4	1816.7	1551.7	1662.0	1658.2	1825.5	1807.6	905.9	1820.9
PE15	PE16	PE17	PE18	PE19	PE20	PE21	PE22	PE23	PE24	PE25	PE26	PE27	PE28
1834.4	1855.4	1895.1	1885.6	1938.9	2048.1	1835.5	1978.3	2033.7	1966.4	1987.5	2096.1	2010.8	2025.9
PE29	PE30	PE31	PE32	PE33	PE34	PE35							
2020.5	2008.4	2062.7	2084.2	2074.8	2065.5	2075.9							

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TABLE 3
SAMPLE OF TABULATED DATA

TEST	PART	POINT	TEST-SECTION CONFIGURATION	DIFFUSER CONFIGURATION	DATE	HR	MN	SC
366	301	1	1.002	5.001	8/28/78	13	3	6

PRESSURE RAKE - TOTAL PRESSURES

PTD101	PTD102	PTD103	PTD104	PTD105	PTD106	PTD107	PTD108	PTD109	PTD110	PTD111	PTD112	PTD113
2123.1	2126.5	2125.9	2126.6	2139.2	2142.3	2154.7	2167.0	2177.9	2188.0	2185.6	2186.5	2189.0

PTD201	PTD202	PTD203	PTD204	PTD205	PTD206	PTD207	PTD208	PTD209	PTD210	PTD211	PTD212
2147.0	2154.6	2165.0	2180.1	2195.3	2208.8	2216.5	2211.9	2209.8	2200.3	2196.2	2199.1

PTD301	PTD302	PTD303	PTD304	PTD305	PTD306	PTD307	PTD308	PTD309	PTD310	PTD311	PTD312
2171.4	2182.9	2192.5	2200.4	2217.2	2232.5	2247.2	2253.5	2251.0	2247.8	2226.1	2211.2

PTD401	PTD402	PTD403	PTD404	PTD405	PTD406	PTD407	PTD408	PTD409	PTD410	PTD411	PTD412
2137.9	2148.4	2160.8	2168.6	2182.9	2191.1	2200.4	2207.5	2205.5	2210.5	2204.6	2201.8

PTD501	PTD502	PTD503	PTD504	PTD505	PTD506	PTD507	PTD508	PTD509	PTD510	PTD511	PTD512
2130.2	2130.2	2137.1	2146.4	2151.2	2050.8	2046.4	2185.8	2193.2	2046.5	2050.8	2195.5

PTD601	PTD602	PTD603	PTD604	PTD605	PTD606	PTD607	PTD608	PTD609	PTD610	PTD611	PTD612
2156.1	2167.0	2176.5	2183.1	2194.1	2203.4	2212.4	2215.9	2238.8	2228.2	2220.3	2213.1

PTD701	PTD702	PTD703	PTD704	PTD705	PTD706	PTD707	PTD708	PTD709	PTD710	PTD711	PTD712
2158.9	2167.8	2170.7	2179.4	2190.4	2200.4	2050.1	2227.5	2233.7	2230.1	2219.4	2211.6

PTD801	PTD802	PTD803	PTD804	PTD805	PTD806	PTD807	PTD808	PTD809	PTD810	PTD811	PTD812
2150.1	2161.8	2174.1	2193.4	2226.9	2243.8	2252.8	2248.5	2238.3	2217.2	2201.2	2197.1

PRESSURE RAKE - STATIC PRESSURES

PD1	PD2	PD3	PD4	PD5	PD6	PD7	PD8
2123.0	2121.0	2123.2	2123.1	2120.9	2124.4	2118.9	2125.3

FLOW RATES			SUCTION FLOW ORIFICE					REENTRY FLOW ORIFICE				
WT	WS	WRA	PS1	PS2	DELPS	CWS1	CWS2	PRA1	PRA2	DELPRA	CWRA1	CWRA2
53.89	1.53	1.48	904.8	893.7	11.1	0.39060	0.33281	1877.7	1852.0	25.7	0.17229	0.31715

DIFFUSER INLET - STA. 38.25				DIFFUSER OUTLET - STA. 163.83				
PA1OM	PTA1	AMAA1	ARAA1	PDM	PTDM	AMADMC	PTDMC	ARADMC
878.6	2502.9	1.320	1.074	2122.5	2183.4	0.176	2168.691	3.976

PL COEFFICIENTS		PRESSURE CONE			PRESSURE RECOVERY	
CPLTS	CPLMD	PPC	PB8	RAFP	RTDMC	RTDM
0.1848	0.2058	1859.7	901.6105.000		0.757	0.762

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Table 4. TABULATED DATA NOMENCLATURE

Page 1

Line 1

TEST	Test number
PART	Data part number (a data subset containing variations of only one independent parameter)
POINT	Test point (a single record of all test parameters)
TEST SECTION CONFIGURATION	Code signifying one of several geometric configurations of the model test section
DIFFUSER CONFIGURATION	Code signifying one of several geometric configurations of the model diffuser
DATE	Date of data acquisition, month/day/year
HR MIN SEC	Time of data acquisition, hr:min:sec

Line 2

M	Free-stream Mach number
PT	Total pressure, psfa
P	Free-stream static pressure, psfa
Q	Free-stream dynamic pressure, psfa
TT	Total temperature, °F
T	Free-stream static temperature, °R
$RX10^{-6}$	Unit Reynolds number, per foot
WT	Test section weight flow, lbm/sec
TPR	Tunnel pressure ratio
WA	Average test section wall angle, deg
WS/WT	Ratio of weight flow through test section walls to tunnel weight flow
PC	Tunnel 1T plenum pressure, psfa

Table 4. Continued

Line 3-4 (PART 200-214)

Test Section Static Pipe - Pressures

PPx	Static pressure on test section centerline (see Table 1)

(PART 214-300, 400-438)

PPx	(x = 2, 4, 6, 8, 10, 12) Static pressure in bulge region "above" model support strut
PPx	(x = 14, 16, 18, 20, 22, 24) Static pressure in bulge region "below" model support strut
PPx	(x = 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 28) Static pressure on test section centerline

(PART 301-316)

PPx	Rake total pressure at diffuser inlet (see Fig. 7a), psfa

Line 5-6

Diffuser, Rectangular Section - Static Pressure

PAx	(x = 1 to 25) Static pressures on rectangular diffuser wall, psfa

Line 7-8

Diffuser, Transition Section - Static Pressure

PBx	(x = 1 to 15) Static pressures on transition section wall, psfa

Line 9-10

Diffuser, Conical Section - Static Pressure

PCx	(x = 1 to 18) Static pressures on conical section wall, psfa

Line 11-13

Scavenging Scoop - Static Pressure

PEx	(x = 1 to 35) Static pressures on surface of scavenging scoop, psfa

Table 4. Continued

Page 2

Line 1

Same as Line 1, Page 1

Line 2-9

Pressure Rake - Total Pressure

PTDxxx	(xxx - see Fig. 8 for location) Total pressures at exit of diffuser, psfa

Line 10

PDx	(x = 1 to 8) Static pressures on wall at Station 163.83

Line 11

Flow Rates

WT	Test section weight flow, lbm/sec
WS	Test section suction weight flow, lbm/sec
WRA	Return air weight flow, lbm/sec

Suction Flow Orifice

PS1	Upstream orifice static pressure, psfa
PS2	Downstream orifice static pressure, psfa
DELPS	Static pressure difference across suction airflow orifice, psfa
CWS1	Suction orifice flow constant 1
CWS2	Suction orifice flow constant 2

Reentry Flow Orifice

PRA1	Upstream orifice static pressure, psfa
PRA2	Downstream orifice static pressure, psfa

Table 4. Continued

DELPRA	Static pressure difference across reentry airflow orifice, psfa
CWRA1	Reentry air orifice flow constant 1
CWRA2	Reentry air orifice flow constant 2

<u>Line 12</u>

<u>Diffuser Inlet - Station 38.25</u>

PA16M	Mean static pressure at diffuser inlet, psfa
PTA1	One-dimensional total pressure at diffuser inlet, psfa
AMAA1	One-dimensional Mach number at diffuser inlet, psfa
ARAA1	Geometric flow area at diffuser inlet, ft^2

<u>Diffuser Outlet - Station 163.83</u>

PDM	Average static pressure at diffuser outlet, psfa
PTDM	Average total pressure at diffuser outlet, psfa
AMADMC	One-dimensional Mach number at diffuser outlet, psfa
PTDMC	One-dimensional total pressure at diffuser outlet, psfa

<u>Line 13</u>

<u>PL Coefficients</u>

CPLTS	Pressure loss coefficient through test section
CPLMD	Pressure loss coefficient through model diffuser

<u>Pressure Cone</u>

PPC	Static pressure in pressure cone, psfa

Table 4. Concluded

PB8	Static pressure just downstream of reentry air flaps in model diffuser, psfa
RAFP	Reentry air flaps position, counts
	<u>Pressure Recovery</u>
RTDMC	Calculated model diffuser pressure recovery
RTDM	Model diffuser pressure recovery